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ABSTRACT

This paper describes plans for a four-day workshop for college and university faculty to provide instructors exposure to the workings of a successful online educational system and to open up for discussion such issues as what type of technological enhancements would facilitate the online teaching of mathematics and science courses, which have proven to exhibit unique characteristics that need not be addressed in a social science or humanities course. The Teaching and Learning of Mathematics and Science on the Internet Workshop will also address how one must compensate for the lack of social interaction that is often a motivating factor in the traditional classroom; the level of integrity with regard to a student's work in an online course; the appropriate amount of rigor for an online course versus that of the traditional undergraduate/graduate course; and the further exploration of the issues of evaluation and assessment. The workshop will focus on the use of the Mercy College (New York) Long-distance Instructional Network (MerLIN). This paper describes: (1) workshop content; (2) content of a session on a MerLIN course; (3) laboratory sessions; (4) curriculum projects; (5) group discussions; (6) follow-through activities; and (7) evaluation and dissemination. (Contains 10 references.) (DLS)

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Teaching Mathematics, Science and Technology on the Internet: A Workshop (Description) for Educators in the New Millennium

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The new millennium will bring a change in the educational environment that will, in turn, alter the traditional student-teacher relationship. Advances in technology, academic research, and the increase in the chronological age and personal commitments of the average college student are contributing factors to the metamorphosis in the traditional structure of the educational environment (Newman 1996; Johnstone & Krauth 1996).

Progress made in the fields of computer hardware and software is encouraging colleges and universities to offer courses via distance learning programs (Means 1993). These programs include courses that are online on the Internet or at least include a substantial online component (Ben-Jacob & Tucciarone 1997; Hiltz 1995; Saba 1996).

The differences in the media and format used directly affect the relationship between instructor and student. The role of the professor or teacher is changing to that of a facilitator as the model for education moves to student-centered prototype.

The online teaching and learning of material are still in relatively innovative stages. There are still many questions to be answered and issues to be discussed to insure that online education remains a possible means of gaining knowledge and receiving formal confirmation of it (Johnstone & Krauth 1996).

The use of distance learning technologies for instruction is growing and institutions of higher education are adopting interactive technologies. We need to insure the integration and success of the new media and formats into our learning environments. As such, we plan to run a four day workshop for college and university faculty to provide instructors exposure to the workings of a successful online educational system, to open up for discussion such issues as what type of technological enhancements would facilitate the online teaching of mathematics and science courses, which have proven to exhibit unique characteristics that need not be addressed in a social science or a humanities course; we will address how one must compensate for the lack of social interaction that is often a motivating factor in the traditional classroom when one cannot read the expressions on the faces of the students. In addition, we will consider the following: the level of integrity with regard to a student's work in an online course; the appropriate amount of rigor for an online course versus that of the traditional undergraduate/graduate course; the further exploration of the issues of evaluation and assessment (Ben-Jacob & Tucciarone 1997; Johnstone & Krauth 1996). One of the most fundamental distance learning questions is the one with regard to course content: Should the course content be adjusted to the medium or just relayed in the new fashion (Burgstahler 1997).

We are interested in problem-based learning and collaborative learning, both with regard to students in an online course and our workshop participants (Albanese 1993; Hiltz 1990). We

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believe a camaraderie will be formed and maintained by our participants; this is very essential as our corps of participants will mostly be coming from small institutions that are in their early stages of their distance learning programs, and that may not have large research groups. We will encourage the participation of women, minorities and handicapped persons, who are sometimes underrepresented among research science groups. The workshop will help insure the future success of the virtual university by forming a network of academicians who will continue to brainstorm upon their ideas and knowledge, and those presented at the workshop with regard to the teaching and learning of mathematics and science on the Internet (Turoff 1995).

This paper describes our workshop, which will be sponsored in part by a National Science Foundation grant.

Workshop Content

The Teaching and Learning of Mathematics and Science on the Internet Workshop will incorporate lectures, interactive discussions between presenters and participants, a panel discussion, hands-on, assisted laboratories, and open labs. It will serve as a forum for the concepts and issues relevant to successful online education, particularly for mathematics and science. The workshop will not try to exhibit an in-depth analysis of one particular mathematics or science course. Instead it will give an overview of what the online courses have in common, and what issues are unique to each subject. It will allow for the examination of MerLIN, the Mercy College Long-distance Instructional Network and discuss its features. It will allow for the generic topics that pervade virtual courses and the special considerations that one must give to mathematics and science courses. Guidelines for assessments, homework, examinations and projects will be examined. Participants will learn how to obtain information about distance learning from the Internet.

The following components will be integral to the Workshop:

- Discussion of a running, online educational system and hands-on laboratory sessions using MerLIN. Further discussion of the necessary features for such a system to be successful.

- Presentations of how certain courses were presented when taught online. A comparison with the same courses in the traditional classroom setting. We will have a session dealing with mathematics, computer science, computer information science, physics, chemistry, and biology.

- A panel comparison of the advantages and disadvantages between the traditional classroom and the virtual classroom. Included on this panel will be a brain researcher, a psychologist, faculty with contrasting views of online courses, and a student who has taken courses on MerLIN.

- A discussion of what type of pedagogy is most effective for the different approaches to teaching and learning online and offline

- Assessment

- The change (if any) in the psychology of teaching online versus that in the traditional classroom
- The methods needed for increasing cooperation among students and instructors using this medium
- A plan for continued interaction among the participants after the workshop
- A plan for disseminating the contents and results of the workshop

Content of a Session on a MerLIN Course

In his/her workshop, each leader will include the following:

- A detailed explanation of how he/she taught using MerLIN
- The differences between the content of the online course and its traditional classroom equivalent
- The differences between the examinations and projects of the online course and its traditional classroom equivalent
- Which features of MerLIN were used
- What additional capabilities he/she would like to see in a distance learning system
- His/her opinion of the difference in the amount of knowledge gained by the students in the online course versus the students in a traditional classroom setting
- How he/she compensated for lack of face-to-face interaction
- His/her projection of the future of distance learning in general, and specifically at Mercy College
- Why he/she is or is not a supporter of distance learning
- Why students are pro/con distance learning
- Open discussion

Laboratory Sessions

In the scheduled laboratory session, participants will learn how the MerLIN system works and how it has been used and is being used for courses in mathematics, and the sciences. Participants will be able to carry out the interaction required by an instructor and a student from both the perspective of the student and the instructor in an online course. They will critique the resources and suggest improvements from the perspectives of the media facilities, the pedagogical content, and the course content. In addition, they will become familiar with the Internet and how to locate resources relevant to online teaching. The

Director and/or the Assistant Director of Distance Learning and faculty leaders will be present during the laboratory sessions. Student assistants will also be available to help.

Curriculum Projects

At the conclusion of each session, we will ask for the participants' input with regard to the session and suggestions for possible improvement We will encourage them to record their ideas, since on the final day of the workshop, they will be asked to work in groups and suggest responses to the following issues:

- Course content of an online course versus the content of a traditional course
- Evaluation of the student work in an online course
- Overcoming the lack of face-to-face interaction
- Lowering of the withdrawal rate from online courses
- Increasing student online participation in a course, particularly with regard to collaborative learning with the other students
- Determining which type of student is most likely to be successful with online learning, and how to increase the success rate of other students
- Identify the necessary software capabilities to facilitate online instruction.
- Enhancing the future interaction and networking of the group of participants

Group Discussions

Group discussions are an integral part of the Workshop and will take place after each session, including the labs and the panel discussion. The participants will be encouraged to address the following issues, as well as others that are on their minds:

- How familiar with computers should an online student be?
- Which type of student will be most successful online, and how do we encourage other students to participate successfully?
- How do we assess students in online courses?
- How, if at all, should we alter our methods of information delivery and our teaching styles for online courses?
- What are the advantages and disadvantages of online courses, for the institution, the professor and the students?
- How do we integrate ultimate cooperation between the student and the professor?
- What are examples of appropriate online assignments, projects, and exams?
- How do we insure academic integrity in the online learning environment?
- How do we expand the network of those persons committed to the new ways of imparting information?

The goal is to have faculty participate who will make the most significant improvements in online teaching of mathematics and science courses at their institutions. Preference will be given to those who come from smaller institutions that have shown serious interest in establishing online courses as an option for their students or who are in the early stages of their distance learning programs. We feel these people will have the most to gain from the Workshop Priority will be given to colleagues of institutions in the northeast region for the first Workshop because we will tap on our local contacts for recruitment. We hope the network formed by the participants will be tight. Our core network will be strongly bonded. Having participants from the same, somewhat local geographic area will facilitate

participation at the follow-up workshop in the Spring. The following year we will recruit nationally for the workshop, and deliver the entire workshop online. After all, the ultimate distance learning workshop should epitomize distance learning at its best!

Follow-Through Activities

The Teaching of Mathematics and Science on the Internet Workshop at Mercy College will yield several products which will, together, comprise a packet of materials to be used at this and other institutions. The questionnaires completed by participants will yield data which will form the basis of study-papers, the first of which we will prepare during the summer of 1998. This first study paper will be comparing pre and post workshop results, and will include suggestions for institutional services necessary to enhance support and information for this mode of teaching. We will videotape sessions of the workshop and during the summer and fall of 1998, these tapes will be edited into one sixty-minute tape. This tape, along with the study paper and other pedagogical and technical materials that we will collate, can be used as reference material for the participants and others, and can serve as the basis for mini-workshops, or faculty seminars at different institutions.

Follow-through activities are of significant importance to all workshops, and particularly so for the one we propose as we envision the online teaching of mathematics and science courses as being in its innovative stage and as an evolving process. Many of the faculty participating will not be affiliated with major university and will benefit greatly from the interaction with colleagues. Part of the packet provided to all participants will include the surface and e-mail addresses and the telephone numbers of the other participants. Participants will remain in contact to share ideas and pedagogical material based on actual experiences. In addition, we plan to design and set-up a repository so that all participants can easily keep abreast of information related the teaching of mathematics and science on the Internet.

An additional way of expanding our extended coterie is the inclusion of two of the participants as leaders of discussion groups in the workshop the following year. Their participation and sharing of experiences would exemplify how the workshop's material can be implemented in other environments. It would also serve to expand the network formed by the participants, and those actively interested in promoting the future of the online university.

We plan on having a one-day follow-up workshop during the Spring of 1999 to assess the impact of the Workshop. The participants will share their experiences in integrating the material into their courses at their institutions. At this time, a third evaluation will be completed by the participants to assess the impact of the workshop on their teaching and curricula. A second study-paper will be written based on these results.

Evaluation and Dissemination

The Teaching of Mathematics and Science on the Internet Workshop is to disseminate information in a context that maximizes the likelihood that participants will retain and act on the information received. Therefore, in our evaluation component, we must determine (a) whether participants have, in the course of the workshop, become aware of new information relative to the teaching of mathematics and science on the Internet, and

(b) whether they are likely to integrate what they have learned into the appropriate courses they teach at their own institutions.

To gather this information, we will ask all participants to complete three questionnaires, one as part of the Workshop application (pre-test) which will measure the level of participants awareness, and experience before the Workshop, one as part of the Workshop's evaluation which will be filled out at the conclusion of the workshop (post-test) and will measure any growth in awareness, and finally, one during the follow-up Workshop in the Spring of 1999, measuring the participants' integration of the information gleaned into their own courses at their own institutions. These will contain both short answer and open-ended questions to allow for greater detail.

The questionnaires to be completed at during the Workshop will also serve as a critique of both the content and format of the Workshop. Based on these results, the Workshop will be modified the following year.

The new millennium brings with it a change in the academic environment. The relationship between teacher and student will undergo a transformation, and we, as educators, are obligated to facilitate this transformation. A workshop that brings educators together to brainstorm upon ideas and information, and form a pedagogical network is one way of insuring the success of higher education in the 21st century.

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Autobiographical Sketch

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